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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/891,213	06/26/2001	Shigeo Irie	740819-585	9379

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EXAMINER

SAGAR, KRIPA

ART UNIT	PAPER NUMBER
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1756

DATE MAILED: 02/26/2003

6

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/891,213

Applicant(s)

IRIE, SHIGEO

Examiner

Kripa Sagar

Art Unit

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 03 February 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-6 is/are pending in the application.
- 4a) Of the above claim(s) 5 and 6 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-4 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 26 June 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
- 1) ☒ Certified copies of the priority documents have been received.
 - 2) ☐ Certified copies of the priority documents have been received in Application No. _____.
 - 3) ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ 6) ☐ Other: _____

DETAILED ACTION

Election/Restrictions

1. Applicant's election without traverse of Claims 1-4 in Paper No. 5 is acknowledged. Claims 5,6 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected apparatus, there being no allowable generic or linking claim. Election was made **without** traverse in Paper No. 5.

Claims 1-4 are under consideration.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. Claims 1-4 are rejected under 35 U.S.C. 103(a) as being unpatentable over US Pat. 5698113 to Baker et al. in view of US Pat. 6394109 to Somekh and further in view of US Pat. 5466942 to Sakai et al.

The claims recite cleaning a EUV (extreme UV) mask using O₂-plasma prior to using the mask in an exposure apparatus. The O₂-plasma cleaning may be carried out in the exposure chamber or in an external chamber integrated with the exposure tool.

Baker teaches that EUV masks are known to deteriorate in performance due to surface contamination (1;29-32). Baker teaches dry plasma etching to remove the multilayered reflecting surface for the purpose of reworking the mask (2;29-41).

Baker does not teach in-situ etching of the mask in an exposure chamber or in an integrated etching-exposure cluster tool.

Somekh teaches cleaning electron beam (EB) lithography masks (2;1-20). Carbon deposits on the masks are unwanted material (Fig.1). The deposits are cleaned by oxidizing them within the chamber (2;63-3;6). Oxygen plasma may be introduced in the process chamber to oxidize the deposit. Somekh teaches integrated cluster-tools with in-line transportation between tools (6;26-30).

Somekh does not teach external processing of the mask.

Sakai's and Somekh's inventions are in the same art and solve the same problem. Sakai teaches that the use of O₂-plasma cleaning of masks and components of a charged particle beam (CPB) lithography apparatus is known in prior art (2;8-13). Sakai's improvement consists in using neutral radical of oxygen to remove the carbon-based deposits in the CPB chambers. The carbon-based deposits are oxidized to form volatile gases which are pumped out (5;58-6;20). The radicals may be produced outside the apparatus and pumped into the chambers or the cleaning may be accomplished in a separate chamber (7;14-38).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to clean Baker's EUV masks using O₂-plasma as taught by Somekh or by using external chambers as taught by Sakai because Somekh teaches that plasma cleaning of masks in an exposure tool is feasible and cost-effective (10;8-13) while Sakai teaches that external chambers are portable and thus reduce capital costs (7;39-43).

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4. Claims 1-2 are further rejected under 35 U.S.C. 103(a) as being unpatentable over US Pat. 5928817 to Yan in view of US Pat. 5582939 to Pierrat .

Yan teaches the fabrication of a EUV-mask. Positive defects (34) in the mask are etched using ion-milling which leaves a stain (40) on the lower layer (fig.2,3). Yan does not explicitly teach using the mask in an exposure process; however the invention is directed to EUV lithography which includes exposing a resist to EUV using a mask. (1;5-10).

Yan does not teach plasma etching the defects (cl-2).

Pierrat teaches defect repair in the fabrication of UV masks. Bump (positive) defects are conventionally removed by Ga-ion milling (fig.2) similar to Yan's process (2;54-3;4). Pierrat's improvement lies in removing the bump defect by dry-etching (3;41-52). The etching process includes an O₂-containing plasma (6;24-61).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to use O₂-plasma as taught by Pierrat to remove unwanted deposits from Yan's EUV mask because Pierrat teaches that it does not stain the underlayer and is simple to implement (3;5-13).

5. Claims 3,4 rejected under 35 U.S.C. 103(a) as being unpatentable over Yan in view of Pierrat and further view of Somekh and further view of Sakai.

These claims teach in-situ plasma etching in the exposure chamber and etching in an external chamber.

While Yan teaches defect removal from a EUV mask and its use in EUV lithography it does not teach plasma etching. Pierrat solves the same problem using O₂-plasma etching but does not teach using the process in-situ in an exposure tool or in an integrated etching chamber.

Somekh teaches cleaning electron beam (EB) lithography masks (2;1-20). Carbon deposits on the masks are unwanted material (Fig.1). The deposits are cleaned by oxidizing them within the chamber (2;63-3;6). An oxygen plasma may be introduced in the process chamber to oxidize the deposit. Somekh teaches integrated cluster-tools with in-line transportation between tools (6;26-30).

Somekh's invention does not apply to a EUV mask. It does not teach external processing of the mask.

Sakai's and Somekh's inventions are in the same art and solve the same problem of cleaning deposits on masks. Sakai teaches that the use of O₂-plasma cleaning of masks and components of a charged particle beam lithography apparatus is known in prior art (2;8-13). Sakai's improvement consists in using neutral radical of oxygen to remove the carbon-based deposits in the CPB chambers. The carbon-based deposits are oxidized to form volatile gases which are pumped out (5;58-6;20). The radicals may be produced outside the apparatus and pumped into the chambers or the cleaning may be accomplished in a separate chamber (7;14-38).

It would have been obvious to remove unwanted material from the surface of Yan's EUV mask using O₂-plasma as taught by Pierrat, using the process in-situ as taught by Somekh or from an external chamber as taught by Sakai, because Pierrat

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teaches that O2-plasma etching is cost-effective (3;5-13), while Somekh teaches that in-situ cleaning reduces down-time and increases throughput (10;8-13) while Sakai teaches that that external chambers are portable and thus reduce capital costs (7;39-43).

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kripa Sagar whose telephone number is 703-605-4427. The examiner can normally be reached on M-F.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mark F Huff can be reached on 703-308-2464. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9310 for regular communications and 703-872-9311 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703.

MH/ks
February 14, 2003

A handwritten signature in black ink, appearing to read "Mark F. Huff", with a long, sweeping horizontal line extending to the right.

**MARK F. HUFF
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 1700**